

INVITED COMMENTARIES

Regarding “Laparoscopic remodeling of abdominal aortic aneurysms after endovascular exclusion: A technical description”

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The injury and destruction of normal healthy tissue to achieve repair of diseased tissue is the great anathema of surgery. This is a prominent feature of open aortic aneurysm resection. Whether performed through a midline abdominal incision or a retroperitoneal approach, the conduct of the procedure is similar, with division of soft tissues, retraction of the intestines for a significant period of time, the placement of vascular clamps, and the suture repair of these tissues. Numerous physiologic alterations occur that are virtually coincident with surgical tissue injury and proportional to its extent.^{1,2} The consequences of these alterations are well known and may affect outcomes. Concentrations of circulating neuroendocrine mediators rise significantly and remain elevated for a prolonged period of time after the procedure. Nearly a decade ago, Riles and associates³ documented rapid elevations in plasma epinephrine and norepinephrine levels during open aneurysm resection and suggested a link between these stress mediators and postoperative myocardial ischemia. This link between the neuroendocrine response to surgery and postoperative myocardial ischemia has been confirmed by others, strengthening the relationship between tissue injury and adverse outcome.⁴

Long-term outcome may also be affected. White and colleagues⁵ noted a 5-year survival rate in patients aged 60 to 70 years undergoing open aneurysm resection of 67% compared with that of 88% in age-matched controls. Aune and associates⁶ noted a 10-year survival rate of patients undergoing aneurysm resection of 38% compared with 52% for the matched controls. The majority of deaths are cardiac in origin and strongly argue for the development of alternative methods of aneurysm repair that are more specific and associated with minimal tissue destruction.

It is well recognized that the treatment of vascular disease through percutaneous procedures is associated with less tissue trauma. There is a lower rate of postintervention myocardial infarction compared with open surgery, and this may also result in a long-term cardiac benefit. Reviewing the results of the Veterans Affairs study comparing angioplasty with surgery for the treatment of superior femoral artery disease, Bergan and colleagues⁷ noted a sustained reduction in cardiac deaths in those treated percutaneously compared with those treated with femoropopliteal bypass. The impact of such results has been limited because balloon angioplasty as a treatment for lower extremity arterial occlusive disease generally does not provide the same degree or durability of circulatory improvement as open bypass procedures. The same indictment cannot be applied to aortic stent graft placement. This technology, when appropriately applied, effectively excludes an aortic aneurysm and significantly reduces the likelihood of associated complications. Additionally, there has been a growing body of data regarding a reduction of the neuroendocrine response associated with this form of aneurysm repair. In a study of 10 patients undergoing aortic stent grafts compared with 10 patients having open aneurysm resection, Salartash and colleagues⁸ measured epinephrine, cortisol, insulin, and retinol-binding protein levels before, during, and after intervention. Peak epinephrine levels rose 1.6-fold in the stent graft group compared with a 9.6-fold increase in the open resection group. Thompson and associates⁹ documented greater rises in plasma catecholamine concentrations, more significant changes in cardiovascular parameters, and greater alterations in acid-base status in patients undergoing open aneurysm resection compared with those having aortic stent graft placement. Such studies, while few, suggest that these reductions in stress mediators may result in a decreased cardiac mortality and support the use of aortic stent grafts.

Despite the promise of improved long-term outcomes, however, these new technologies are not without attendant complications. After more than a decade of development, application, and evaluation of these devices, unpredictable shortcomings are still being discovered. Fabric holes, degradation of the metal exoskeleton or fixation sites, en-

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Competition of interest: nil.

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J Vasc Surg 2002;36:1271-3.

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0741-5214/2002/\$35.00 + 0 24/9/129489

doi:10.1067/mva.2002.129489

doleaks, and slippage represent some of the more vexing unforeseen problems with this technology. Many of the patients who have sustained such complications have been treated with open surgery, thereby eliminating the benefits of a percutaneous approach.

In this issue of the Journal, Kolvenbach and colleagues have presented a feasibility study of using minimally invasive surgical techniques to enhance the results of aortic endografting. The use of minimally invasive techniques is appropriate in this setting because of its association with a reduced neuroendocrine response. Comparisons between open and laparoscopic cholecystectomy have documented a blunting of the stress response with the minimally invasive procedure.¹⁰ Since these operations are otherwise the same, the reduction in the level and duration of stress mediators has been attributed to the smaller incisions of the laparoscopic procedure. The trend toward lower stress responses with less tissue injury has been confirmed for other minimally invasive procedures as well. Grossi and associates¹¹ compared open versus port access coronary artery bypass procedures and, as expected, noted lower epinephrine levels in the minimally invasive group. Therefore, minimally invasive procedures, like percutaneous interventions, minimize the postoperative stress response and these technologies may be complementary.

The authors have developed a technique of hand-assisted minimally invasive aneurysm resection and previously reported their results in a series of 24 patients.¹² The patients, unsuitable for endovascular aneurysm repair, were treated with the minimally invasive approach with good technical results. The patients had placement of a vascular graft sewn into position in standard manner. The only difference between the authors' approach and open surgery is the use of smaller incisions causing less tissue injury. Though no long-term follow-up has been presented, results that are at least equivalent to open surgery would be expected.

The authors have now extended their efforts to the treatment and prevention of complications of aortic stent grafts. They have chosen to address graft migration, luminal thrombus, and type II endoleaks. Great caution must be exercised, however, when developing new technology or new applications for existing technology. The goal of new technology is an improvement in the standard of patient care. To document this, physicians must demonstrate that the intervention equals or exceeds the standards of current therapy when similarly applied. This may require years of assessment. The combination of unproven technologies is to be avoided because of the undefined risks it poses to patients. To appropriately address graft migration, aneurysm sac thrombus, and type II endoleaks, investigators must know the incidence and impact of these complications. Graft migration may occur in patients in whom the device was not correctly sized or deployed or in whom the aortic neck has significantly expanded. It is device related, occurring more frequently with friction-type fixation. The conditions promoting graft migration have not yet been

well defined, and its incidence appears to be low. In a recent report, it was identified in only one of 242 patients followed for up to 4 years.¹³ The long-term benefit to endograft patients of the blind placement of device fixation sutures in the aortic neck as suggested by the authors is unknown. The potential for breach of the fabric and accelerated deterioration exists. Similarly, laparoscopic extraction of intraluminal thrombus may be of limited value to patients with a well-functioning stent graft and may jeopardize the stability of the device. No fixation system has been tested and approved to withstand laparoscopic manipulation, and the risk of dislodgment of the graft limbs with thrombus extraction is not known. There is no information to suggest that extraction of aneurysm sac thrombus after the successful placement of an aortic stent graft is of actual or potential benefit. Though the metabolically active thrombus may prolong deterioration of the aneurysm wall, a well-functioning stent graft should eliminate blood flow through the aneurysm and reduce the risk of bleeding. Whether a minimally invasive effort to remove thrombus will increase the likelihood of distal type I endoleaks is unknown.

The authors have demonstrated that minimally invasive surgical techniques can be developed and applied for the treatment of complications of aortic stent grafts. Such an approach will preserve the benefits of a more specific, less invasive form of therapy. The application of such techniques, however, should be rigorously tested in the research laboratory and through clinical trials before being widely employed in patient care.

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- Submitted Aug 13, 2002; accepted Aug 15, 2002.
- See related article by Dr Kolvenbach et al on pages 1267-70.

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